WATER SAVING TOILET DEVICE

by

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Field of the Invention

The present invention pertains to the field of water-saving devices, and more particularly to the field of water saving toilets.

Background of the Invention

Clean water has become a precious commodity in recent years. This can be attributed to increases in population and climatic variabilities causing severe drought to populated areas. The average American uses about 42 gallons of water per day for domestic living. More water is used for toilet flushing than for any other domestic water application. The present invention offers an elegant and economical solution to the problem of water wastage by providing a new device which can be installed in most toilets already in existence or can be installed in newly constructed homes and businesses. The device of the present invention allows the user to select a low volume flush mode for flushing liquid and a higher volume flush mode for flushing semi-solid waste.

The art has put forth several designs to accomplish similar objectives, however, none has achieved this objective in the same manner as the device of the present invention. Some of the more pertinent references are discussed below.

For example, US Patent 6,041,452 to Hsiao describes a water saving toilet which offers variable flush volume. In Hsiao's device this is accomplished by providing two intake water ports at two different levels, each having an independent chain and flapper. Hsiao's device is not suitable for retrofitting the millions of toilets currently in use. In contrast, the present invention provides a float arm which can be retrofitted to existing toilets and permits variable flush volume from a single intake water port, chain and flapper mechanism.

US Patent 5,117,513 to Burrowes describes a toilet handle device which can be retrofitted to existing toilets. The handle of Burrowes comprises a cam which allows water to flow into the intake water port as long as the handle is depressed. In contrast, the device of the present invention does not require the handle to be held in place to allow the water to flow for either volume discharged.

US Patent 5,289,594 to Wiewiorowski et al describes a water saving toilet flush control system which comprises a non-buoyant flapper and an eyelet through which passes a flexible line attached to a buoyancy means. In this device, once the buoyancy means has been adjusted, only one flush volume is available. In contrast, the device of the present invention utilizes a buoyant flapper, and makes two discreet flush volumes available to the user.

US Patent 4,881,279 to Harney describes a dual volume flush toilet. The device described by this patent has two separate handles, one for each flush mode. An advantage of the present invention over this device is that a single handle moving in opposite directions affects the two flush volumes of the present invention as opposed to the two separate handles described by the Harney device.

After a review of the prior art, Applicant asserts that none of the prior art describes, either in whole or in combination, a device which accomplishes the same result in the same way as the present invention.

Summary of the Present Invention

It is an object of the present invention to provide a novel mechanism for controlling the flush volume of a toilet.

It is a further object of the present invention to provide a novel mechanism which can be adapted to almost any toilet now in use.

It is a still further object of the invention to provide a novel mechanism which allows the user of a toilet to easily select at the time of use either a high volume flush or a low volume flush by turning the handle clockwise or counter-clockwise, respectively.

The present invention provides a modified float arm which permits the user to choose a low volume flush by turning the handle counterclockwise,

or a high volume flush by turning the handle clockwise. The low volume flush can be used to effectively evacuate liquid waste from the toilet bowl, while the high volume flush is sometimes needed to evacuate solid waste material from the toilet bowl. By selecting the appropriate volume of water to flush, a significant amount of water is saved.

The modified float arm of the present invention comprises a float rod which has on its distal end two protrusions, one of which is movable, for controlling the length of time and distance that the flapper is open. In addition to the float rod, is a flush control arm which moves with the float rod, but at a different pivot axis. The float rod and the flush control arm move simultaneously to control the length of time the flapper opens and thereby controlling the amount of water discharged. In one embodiment, the flush control arm comprises two essentially parallel sides, although a single piece construction is also contemplated. If the flush control arm has two essentially parallel sides, the float rod travels between the two essentially parallel sides of the flush control arm and serves to control the movement of the barrel and tether. If the flush control arm is constructed of one piece, the float rod travels alongside of the flush control arm. The flush volume is selected by directional variance of the handle. Rotation in one direction directly moves the float rod upward, like is commonly known. Rotation in

the opposite direction actuates a cam mechanism which rotates the flush control arm.

The actual mechanism of the invention is described in more detail in the Detailed Description of the Invention, taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

Fig. 1 is a schematic view of the device of the present invention shown in the "closed" position.

Fig. 2 is a schematic view of the device of the present invention shown in the "open" position for low volume flush.

Fig. 3 is a schematic view of the device of the present invention shown in the "open" position for high volume flush.

Fig. 4 is a side view of the flush control arm.

Fig. 5 is a side view of the float rod.

Fig. 6 is a cutaway front view of the mounting block.

Fig. 7 is a sequence showing the movement of the barrel in the flush control arm past the upper catch in the float rod for the open high volume flush position.

Fig. 8 is a detailed view of the offset mounting positions of the flush control arm and the float rod, and also showing the cam mechanism.

Fig. 9 is a side view of the cam.

Fig. 10 is a side view of the offset mounting positions of the flush control arm and the float rod on the mounting block.

Fig. 11 is a schematic view of the invention showing completion of the high volume flush discharge.

Fig. 12 is a detail of the float rod showing the pin and slot on the primary pivot axis shaft.

Fig. 13 is a detail of the barrel and tether controlling end of the flush control arm showing the single piece embodiment of the flush control arm.

Detailed Description of the Invention

The present invention permits the user to flush the toilet in either of two flush volumes. The two flush volumes are low volume flush for evacuation of liquid waste from the toilet bowl, or high volume flush for evacuation of solid waste from the toilet bowl. The actual volume of both of these flush modes is predetermined by adjusting the placement of the float 20 on the float stem 18, and held in place by float clip 50. This is shown in Fig. 1. If the float is placed lower on (or more distally on) the float stem, the greater will be the volume of water evacuated when the toilet is flushed.

Although the following discussion describes the operation of the instant device having a flush control arm comprised of two essentially

parallel sides, one-piece construction is also envisioned. This one-piece flush control arm is depicted in Fig. 13, which shows additionally, an arcuate gap 106 to accommodate the tether 10. In one-piece construction, the float rod travels alongside the flush control arm. In the case of a two-sided flush control arm, the float rod travels between the two sides of the flush control arm.

LOW VOLUME FLUSH –See Figs. 2, 10 and 12. This is the primary flush mode for the invention and is the flush mode selected when operating the toilet by turning the handle 28 in a counter clockwise direction. When handle 28 is rotated in a counter clockwise direction, the shaft 30 rotates as constrained by the bearing surface 52 of the primary pivot axis 24, then shaft 30 engages the pin 32, which causes float rod 4 to rotate also. Bearing surface 52 is shown in Figs. 6 and 10. Shaft 30 is described herein as being a thin-walled tube creating a hollow shaft, but this feature is not critical to the instant invention and a solid shaft can also be used in the present invention. Pin 32 intersects float rod 4 through apertures 60,62. Shaft 30 passes through float rod 4 through opening 64. This is shown in Fig. 12. Apertures 60,62 are positioned in float rod 4 so that pin 32 is orthogonal to both shaft 30 and primary pivot axis 24. Pin 32 passes through shaft 30 at slots 36, 37. Slots 36,37 in shaft 30, circumferentially describe the outer

surface of the shaft for approximately 90 ninety degrees on opposing outer surfaces of shaft 30. See Fig. 12. This arrangement allows shaft 30 to engage pin 32 when shaft 30 is rotated counter clockwise, but to not engage pin 32 when the shaft is rotated clockwise. This counter clockwise rotation causes float rod 4 to move upward until it contacts stop block 34. Float rod 4 travels between two essentially parallel sides of flush control arm 2. This can be seen in Figs. 1 and 3. As the float rod 4 moves upward it carries with it the barrel 14, the tether 10 and flapper 12. Flapper 12 remains open until the level of the water falls below the buoyancy capability of the float 20 which then causes float rod 4 to rotate clockwise and downward as the water drains to a level at which the flapper 12 closes. Once the flapper 12 closes, the water reservoir inside the toilet refills until the high water level control float reaches its stop in the customary fashion. When the high water level control float reaches its stop, the water flow ceases and the toilet is ready to be flushed again. The high level control float is not shown in the drawings in order to clarify the actual novel features of the present invention, but is contemplated to be a high level control float as is commonly utilized in toilets.

FULL(HIGH) VOLUME FLUSH (Note that the high volume flush does not drain the reservoir, but dispenses the legal maximum of

approximately 1.6 gallons per flush) – This is the flush mode to be used for evacuating solid or semi-solid waste from the toilet bowl and is brought about by turning the handle 28 in a clockwise direction, as shown in Fig. 3. When the handle 28 is rotated in a clockwise direction, the shaft 30 rotates clockwise about primary pivot axis 24. This rotation has no effect on the float rod 4 because there are slots 36,37 on the primary pivot axis shaft 30 which allows the float rod 4 to rotate counter clockwise with respect to shaft 30 without engaging pin 32 which pin 32 passes through slots 36, 37 in the shaft 30 that intersects the shaft 30 and is perpendicular to the primary pivot axis 24. These features are depicted in Fig. 12. Clockwise rotation of shaft 30 has no effect on the float rod 4 because slots 36, 37 in shaft 30 allow shaft 30 to rotate clockwise with respect to the float rod 4 without engaging pin 32. Cams 38, 40 are fixed to the primary pivot axis shaft 30 so that by rotating the shaft 30 clockwise, the lobes 42, 44 on the flush control arm are engaged which causes the flush control arm 2 to rotate in a counter clockwise direction, which pivots about the secondary pivot axis 26 as constrained by the secondary pivot axis shaft 48. This is shown in Fig. 6. The above description of the invention refers to two cams 38, 40 for two-piece construction of the flush control arm and two lobes 42,44 to engage

the cams. However, one-piece construction of the flush control arm would have only one lobe 42, and therefore only one cam 38 to engage lobe 42. As with the low volume flush mode, float rod 4 travels in between the two essentially parallel sides of flush control arm 2. Movement of the flush control arm 2 in a counterclockwise direction raises the barrel 14, which is connected to the tether 10 and the flapper 12, thereby lifting flapper 12. At the same time the flush control arm 2 moves upward, the float rod 4 also moves upward due to its buoyancy created by float 20. Float rod 4 moves upward until it reaches stop block 34 located on mounting block 22. Continued manual clockwise rotation of the handle 28 causes continued counter-clockwise rotation of flush control arm 2 about the secondary pivot axis 26 until the cams 38, 40 contact the stop 56 which limits the clockwise rotation of the handle 28. Stop 56 is a protrusion located on either one or both lobes 42, 44. This feature is shown in Fig. 4. Continued rotation causes the barrel 14 to move up past the upper catch 6 on float rod 4. When barrel 14 moves upward, it contacts the lower surface of upper catch 6 and causes upper catch 6 to rotate counter clockwise. This rotation of upper catch 6 permits the barrel 14 to move past the upper catch 6. This is shown in Fig. 7. Spring 16 returns upper catch 6 to its original position, thereby preventing the downward movement of barrel 14. Barrel 14 always travels inside slot

46 on float rod 4. Due to kinematic constraints the tether 10 is required to be elastic and of a spring constant sufficient to be able to lift the flapper 12 and overcome the hydrostatic forces of the water without too much elongation, but of a small enough spring constant so that it can stretch the length necessary to allow the barrel 14 to move past the upper catch 6 without appreciable resistance. For example, a tether having a spring constant defined by force/distance of approximately 6 to 10 pounds per inch is suitable for use in the present invention. When barrel 14 moves up past the upper catch 6, upper catch 6 is forced down by means of spring 16. The movement of upper catch 6 by spring 16 prevents the barrel 14 from moving down. This mechanism holds the flapper 12 open to allow evacuation of the toilet bowl. At this point, the handle is released and the return spring 58 (shown in Fig. 6) returns the handle 28 to its original position. The flapper 12 remains open until the water level drops to the point of the limit of the buoyancy capability of the float 20. At that point, both float rod 4, flush control arm 2, and the flapper 12 start rotating clockwise as the water level drops. The float rod 4 and flush control arm 2 have different pivot axes. Primary pivot axis 24 is the pivot center for the float rod 4, and secondary pivot axis 26 is the pivot center for the flush control arm 2. The offset pivot centers of the primary pivot axis 24 and secondary pivot axis 26 is

critical to the instant invention. Although the present invention is described with respect to a specific relationship between the pivot axes, other relationships have been contemplated and are considered to be included in the scope of this invention. For example, the relationship can be optimized for a variety of applications, such as manufacturing considerations, or different toilet reservoir shapes.

In the present embodiment, as the water level drops, the difference between the arc scribed by the float rod 4 at the upper catch 6 and the arc scribed by the flush control arm 2 at the channel 46 causes a gap between the distal end of the upper catch 6, and the distal end of the channel 46 of the flush control arm 2 which allows the barrel 14 to slide off the end of the upper catch 6 on the float rod 4 and onto shelf 8. At this point, the barrel 14 is no longer restrained by the upper catch 6 because the upper catch 6 is rotating away from the distal end of the channel 46 of the flush control arm 2. The force from flapper 12 on the barrel 14 via the tether 10 has a component toward the distal end of the upper catch 6. This results in the barrel 14 always being located at the distal end of the upper catch 6. The barrel 14 moves freely within the channel 46 on the flush control arm 2. When barrel 14 slides off upper catch 6 onto shelf 8, the flapper 12 is relieved from the restraint holding the flapper 12 open and flapper 12 closes.

Similarly the float rod 4 is relieved of the of the weight of the flapper when the barrel 14 drops from the upper catch 6 and therefore rotates counter-clockwise due to the buoyancy of the float 20 until the lower shelf 8 is restrained by the barrel 14, tether 10 and flapper 12 which is held closed by the hydrostatic force of the water.

Once the flapper 12 closes, the water reservoir inside the toilet refills until the high water level control float reaches its stop in the customary fashion. When the high water level control float reaches its stop, the water flow ceases and the toilet is ready to be flushed again.

Although this invention has been described with respect to specific embodiments, it is not intended to be limited thereto and various modifications which will become apparent to the person of ordinary skill in the art are intended to fall within the spirit and scope of the invention as described herein taken in conjunction with the accompanying drawings and the appended claims.